SURFACE VEHICLE STANDARD

J2120™ FEB2023

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Superseding J2120 NOV2009

(R) Personal Watercraft - Electrical Systems

RATIONALE

Alignment with Section 7 of ISO 13590:2022. Most changes in this document are verbiage and document layout for increased clarification. There are some minor technical changes to align with ISO standards.

1. SCOPE

This SAE Standard establishes a uniform test procedure and performance requirements for the electrical system in personal watercraft.

This SAE Standard does not apply to outboard powered personal watercraft and jet powered surfboards.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J378 Marine Propulsion System Wiring

SAE J1127 Low Voltage Battery Cable

SAE J1128 Low Voltage Primary Cable

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/J2120_202302/

2.1.2 ISO Publications

Copies of these documents are available online at https://webstore.ansi.org/.

ISO 8666 Small craft - Principal data

ISO 13297 Small craft - Electrical systems - Alternating and direct current installations

ISO 13590 Small craft - Personal watercraft - Construction and system installation requirements

2.1.3 Other Publications

ABYC E-30 Electric Propulsion Systems

3. DEFINITIONS

3.1 CONDUIT

Any type of rigid plastic or metal piping or tubing which supports the conductors contained within.

3.2 PERSONAL WATERCRAFT

Watercraft intended for sports and leisure purposes of less than 4 m in hull length which uses a propulsion engine having a water jet pump as its primary source of propulsion and is designed to be operated by a person or persons sitting, standing, or kneeling on, rather than within, the confines of a hull.

NOTE: The measurement methodology for the length of hull is defined in ISO 8666.

4. EXEMPTIONS

The following items are exempt from Sections 5, 8, 9, 10, and 11:

a. Circuits having a current flow of less than 1 A.

b. Conductors which are totally inside an equipment housing.

c. Resistance conductors that control circuit amperage.

d. High-voltage secondary conductors and terminations that exist in ignition systems.

e. Conductors less than 175 mm of exposed length outside of a device.

f. Cranking motor conductors.

5. CONDUCTOR TYPE, SIZE, AND IDENTIFICATION

5.1 Each conductor shall be made of insulated, stranded copper.

5.2 Conductor insulation shall be of fire retardant material.

5.3 No conductor shall be used to carry amperage greater than that specified in Table 1 for its cross-sectional area.

5.4 A means of identification shall be used to distinguish individual conductors.

5.5 Table 1 gives permissible continuous current ratings in amperes determined for 30 °C ambient temperature.

Table 1 - Cross-sectional area of conductor, maximum current and minimum stranding

Cross-Sectional Area	Maximum Current, in Amperes, for Single Conductors at Insulation Temperature Ratings						Minimum Number of Strands[a]	
mm^2	60 °C	70 °C	85 to 90 °C	105 °C	125 °C	200 °C	Type 1	Type 2
0.75	6	10	12	16	20	25	16	—
1	8	14	18	20	25	35	16	—
1.5	12	18	21	25	30	40	19	26
2.5	17	25	30	35	40	45	19	41
4	22	35	40	45	50	55	19	65
6	29	45	50	60	70	75	19	105
10	40	65	70	90	100	120	19	168
16	54	90	100	130	150	170	37	266
25	71	120	140	170	185	200	49	420
35	87	160	185	210	225	240	127	665
50	105	210	230	270	300	325	127	1064
70	135	265	285	330	360	375	127	1323
95	165	310	330	390	410	430	259	1666
120	190	360	400	450	480	520	418	2107
150	220	380	430	475	520	560	418	2107

Note 1: The values given in this table are identical to those in ISO 13297.

Note 2: Conductor current ratings can be interpolated for cross-sectional areas between those shown in this table.

[a] Conductors with at least Type 1 stranding shall be used for general craft wiring. Conductors with Type 2 stranding shall be used for any wiring where frequent flexing is involved during use.

For conductors in engine compartments (ambient temperature 60 °C), the maximum current rating in Table 1 shall be de-rated by the factors given in Table 2.

Table 2 - Correction factors

Temperature Rating of Conductor Insulation °C	Multiply Maximum Current from Table 1
70	0.75
85 to 90	0.82
105	0.86
125	0.89
200	1

5.5.1 For information, the voltage drop E under load, in volts, can be calculated using the following formula:

$$E = \frac{0.016\ 4 \times I \times L}{A_c}$$

where:

I = load current, in amperes

L = length of conductor from the positive power source to the electrical device and back to the negative source connection, in meters

A_c = cross-sectional area of the conductor, in square millimeters

5.6 Low-voltage conductors shall comply with either 5.6.1 or 5.6.2.

5.6.1 SAE Standards

5.6.1.1 "Low Tension Wiring" of SAE J378 and

5.6.1.2 The applicable standard of SAE J1127 and SAE J1128.

5.6.2 Equivalent standards to 5.6.1 may also be considered.

6. CONDUCTOR SUPPORT AND PROTECTION

6.1 Each conductor shall be installed so that it is protected from physical damage.

6.2 Except for the first 500 mm of battery cables, conductors shall be supported by clamps or straps not more than 400 mm apart unless the conductor(s) is contained in a conduit.

6.3 Clamps, straps, and conduits shall be designed to prevent damage to the conductor insulation.

6.4 Conductors connecting components that can move with relation to each other shall be protected from stresses.

6.5 Conductors passing through bulkheads, junction boxes, or other rigid surfaces shall be protected against chaffing with a conduit or grommets, or with a protective sheath.

7. EXTERNAL IGNITION PROTECTION

A representative electrical system as installed in the personal watercraft, or in an enclosure simulating the personal watercraft, shall not ignite a propane gas and air mixture (volume fraction: 4.25 to 5.25% propane) surrounding the electrical system when it is operated in the mode in which it draws its maximum current. The test voltage supply shall be adjusted to 120% of the nominal system voltage except for magneto ignition systems.

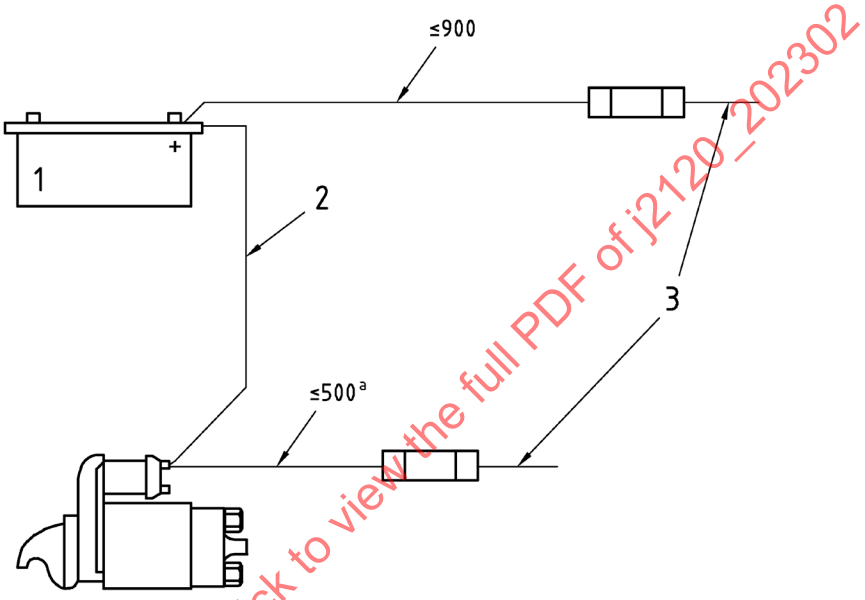
8. OVERCURRENT PROTECTION

8.1 Except for conductors from self-limiting generators or alternators, each ungrounded current-carrying conductor shall be protected by a manual reset trip-free circuit breaker or fuse. The fuse or breaker shall be within 180 mm of the origin of the conductor to be protected, as long as the fuse or breaker is sized for the smallest conductor in the circuit.

If a conductor is continuously protected from physical damage by a sheath or enclosure between its terminal ends, the maximum distance to its protecting fuse or breaker can be increased to 500 mm from the power source measured along the conductor.

An ungrounded supply conductor starting at a storage battery shall have its breaker or fuse within 900 mm of the battery measured along the conductor (see Figure 1).

Dimensions in millimeters



Key

1 Battery

2 Cranking motor conductor (no length restriction)

3 Conductors to various loads as needed (no length restriction)

[a] A distance up to 500 mm is allowed if the conductor, throughout this distance, is contained in an enclosure or sheath junction box, control box or enclosed panel.

Figure 1 - Breaker/fuse location for an ungrounded supply conductor starting at a storage battery

8.2 The voltage rating of each circuit breaker or fuse shall not be less than the nominal voltage of the circuit it is protecting.

8.3 The current ratings of the circuit breaker or fuse shall not be more than 150% of the value in Table 1 for the conductor it is protecting including the correction factor if any part of the conductor is in an engine compartment.

8.4 Circuit breakers or fuses for non-self-limiting generators and alternators shall have a current rating not exceeding 120% of the maximum rated output at 60 °C.

9. CONDUCTOR TERMINATIONS

9.1 All connections outside junction boxes or enclosures shall be made with closed ring, eyelet, captive spade, or mechanical or spring lock-type connectors. Wire nuts shall not be used on any connection.